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(54) ONE COMPONENT DEVELOPER, ITS PRODUCTION AND IMAGE FORMING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To produce a one-component developer stable in the electrostatic charge amt. and carrying amt. of a toner even when being used for a long time and capable of obtaining a high-quality image having high image density and reduced in fogging and to an image forming method using the developer.

SOLUTION: This one-component developer contains at least a binder resin, a coloring agent and a charge controlling agent. As for the charge controlling agent, a resin charge controlling agent containing at least the following monomers as the structural units is used. These monomers are 0.1 to 20 wt.% of sulfonate group-contg. monomer, 1 to 98 wt.% of perfluoroalkyl group-contg. monomer and 1 to 98 wt.% aromatic monomer having electron withdrawing groups based on the weight of the resin charge controlling agent.

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CLAIMS

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[Claim(s)]

[Claim 1] In the 1 component developer which contains a binding resin, a coloring agent, and an electrification control agent at least This electrification control agent at least as a monomer A sulfonate machine content monomer, It is the resin electrification control agent which makes a composition unit a perfluoro alkyl group content monomer and the aromatic monomer which has an electron withdrawing group. The repeat unit of this sulfonate machine content monomer receives a resin electrification control agent weight. 0.1 - 20 % of the weight, The 1 component developer characterized by including the repeat unit of the aromatic monomer in which the repeat unit of this perfluoro alkyl group content monomer has this electron withdrawing group one to 98% of the weight to a resin electrification control agent weight at 1 - 98% of the weight of a rate to a resin electrification control agent weight.

[Claim 2] The 1 component developer according to claim 1 characterized by the aromatic monomer which has the aforementioned electron withdrawing group being the phenyl maleimide substitution product or phenyl itaconimide substitution product replaced by the chlorine atom or the nitro group.

[Claim 3] The 1 component developer according to claim 1 or 2 characterized by the repeat unit of the aromatic monomer which has the aforementioned electron withdrawing group containing one to 70% of the weight to a resin electrification control agent weight.

[Claim 4] A 1 component developer given in any 1 term to the claims 1-3 characterized by the softening temperature (Tmc) of the aforementioned resin electrification control agent being 100-145 degrees C.

[Claim 5] A 1 component developer given in any 1 term to the claims 1-4 to which weight average molecular weight of the aforementioned resin electrification control agent is characterized by being 1000-50000.

[Claim 6] A 1 component developer given in any 1 term to the claims 1-5 characterized by adding the aforementioned resin electrification control agent 0.1 to 20% of the weight to a toner particle.

[Claim 7] A 1 component developer given in any 1 term to the claims 1-6 to which the diameter of distribution in the inside of the toner of the aforementioned resin electrification control agent is characterized by being 0.01-8 micrometers.

[Claim 8] A 1 component developer given in any 1 term to the claims 1-7 characterized by the softening temperature (Tmr) of the aforementioned binding resin being 90-120 degrees C.

[Claim 9] A 1 component developer given in any 1 term to the claims 1-8 characterized by the aforementioned binding resin being polyester.

[Claim 10] A 1 component developer given in any 1 term to the claims 1-9 characterized by the acid numbers of the aforementioned binding resin being 5-30.

[Claim 11] The manufacture method of the 1 component developer characterized by being the manufacture method of a 1 component developer given in any 1 term to claims 1-10, kneading beforehand some aforementioned binding resins and the aforementioned resin electrification control agent, adding the remainder and the coloring agent of the aforementioned binding resin further, and kneading further.

[Claim 12] The latent-image formation process which forms a latent image on a latent-image support.

The development process which develops this latent image using the developer on a developer support, the imprint process which imprints the toner picture on a latent-image supporter on an imprint object, and the fixing process established in the toner picture on an imprint object. It is the image formation method equipped with the above, and is characterized by using a 1 component developer according to claim 1 to 10 as this developer.

[Claim 13] The image formation method according to claim 12 characterized by forming a color picture in the aforementioned development process using yellow, a Magenta, cyanogen, and the color developer of black.

[Claim 14] The image formation method according to claim 12 or 13 characterized by developing a developer support and a latent-image support in the non-contact state in the aforementioned development process.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the image formation method at a 1 component developer and its manufacture method row. Furthermore, it is related with the image formation method at the 1 component developer which is excellent in an electrification property in detail using a predetermined resin electrification control agent, and its manufacture method row.

[0002]

[Description of the Prior Art] Now, the 2 component development method using carriers, such as a toner and iron powder, as a developing [ dryly ] method in the various electrostatography methods put in practical use and the 1 component toner-development method which does not use a carrier are learned. In a 2 component development method, since a developer deteriorates, and only a toner is consumed, when a toner particle adheres to a carrier front face and the concentration rate of the toner in a developer falls, a mixed rate with a carrier must be kept constant, therefore there is a fault of enlargement of a developer. On the other hand, by the 1 component development method, since there is no above-mentioned fault and it has advantages, such as a miniaturization of equipment, it is becoming the mainstream of a development method.

[0003] Moreover, a 1 component toner-development method is classified into the magnetic 1 component development method which uses a magnetic toner, and the nonmagnetic 1 component development method using a nonmagnetic toner. A magnetic 1 component development method holds the magnetic toner which contains the magnetic substance, such as a magnetite, inside using the developer support which prepared magnetic field generating meanses, such as a magnet, in the interior, it carries out lamination by layer specification-part material, and it develops it, and are put in practical use by the small printer etc. in recent years. [ many ] On the other hand, since a toner does not have a magnetic force, a nonmagnetic 1 component development method is what carries out the pressure welding of the toner supply roll etc. to a developer support, supplies a toner on a developer support, is made to hold by the electrostatic force, carries out lamination by layer specification-part material, and is developed. In order for there to be an advantage that it can respond to colorization since the colored magnetic substance is not contained, and not to use a magnet for a developer support, lightweight-izing and low-cost-ization is attained more and it is beginning to be put in practical use by the small full color printer etc. in recent years.

[0004] However, as for the present condition, in a 1 component development method, there are still many improvement technical problems. By the 2 component development method, since a toner and a carrier are conveyed and developed by the back developer support which set inside the development counter, and was stirred and mixed enough, using a carrier as electrification of a toner and a conveyance means, it is easy to respond also to a high-speed developer possible [ maintaining electrification stabilized also in comparatively prolonged use, and conveyance ]. Since there are not stable electrification like [ in a 1 component development method ] a carrier compared with this and a conveyance means, poor electrification / conveyance by prolonged use or improvement in the speed tend

to take place. That is, in a 1 component development method, although lamination of the toner is carried out in layer specification-part material and negatives are developed after conveying a toner to up to a developer support, since contact and the triboelectrification opportunity of a toner and live-part material, such as a developer support and layer specification-part material, are very short, compared with the 2 component development method using a carrier, low electrification or a reversed-polarity electrification toner tends to increase. For this reason, a quicker electrification speed and the moderate amount of electrifications are required of a toner. Especially, since the stable conveyance means is not installed in the nonmagnetic 1 component development method by the magnetic 1 component development method to there being a stable conveyance means of the magnetic force of a magnet roll, a severer electrification property is required of it from a developer.

[0005] In order to stabilize electrification of a toner conventionally, addition of an electrification control agent has been made. For example, the metallic complex of a monoazo color metallic complex, a salicylic acid, a naphthoic acid, and a dicarboxylic acid and the copper-phthalocyanine pigment are known. However, since these electrification control agents are colored, when it is used for a color toner, they have the problem that a hue will change. Moreover, since such an electrification nature control agent has the bad compatibility to a binding resin, the electrification control agent on the front face of a toner which is participating in electrification greatly tends to dissociate it, and dispersion in electrification of a toner and contamination of SURIPUHE tend to produce it. Furthermore, since heavy metal, such as chromium, is contained, these many are posing a problem from the field of safety in recent years.

[0006] Then, in JP,63-184762,A, JP,3-56974,A, and JP,6-230609,A, the resin electrification control agent is indicated as an electrification control agent which has improved the compatibility to a binding resin, the transparency of a toner fixing image, and safety. Since these resin electrification control agents have a binding resin and good compatibility, they are excellent in the stable electrification nature and stable transparency. However, the toner using these resin electrification control agents has the fault that the amount of electrifications and electrification speed are inferior as compared with the toner which used electrification control agents, such as azo stain charge group complex salt. Moreover, although electrification nature improves by increasing the addition of a resin electrification control agent, compatibility with a binding resin falls and there is a problem of having a bad influence on toner fixing nature (offset-proof and low-temperature fixing nature). Furthermore, an electrification distribution is broadcloth and the toner using these resin electrification control agents also had the problem of being easy to produce fogging. Moreover, although it is beginning to be required that the need of a printer is expanded in recent years, the miniaturization of equipment, improvement in the speed, and low-cost-ization progress, high reliability and higher reinforcement are beginning to be required of equipment, and many properties can maintain over a long period of time also to a toner, the conventional resin electrification control agent could not maintain the electrification control effect, but had the problem that where of the electrification performance of a toner falls.

[0007]

[Problem(s) to be Solved by the Invention] this invention is made for the purpose of solving the trouble, without spoiling the advantage of the resin electrification control agent of excelling in the compatibility to a binding resin, the transparency of a toner fixing image, and safety, in view of the above-mentioned actual condition. That is, even if the purpose of this invention continues and it uses it for a long period of time, the amount of electrifications and the amount of conveyances of a toner are stabilized by it, and it has high picture concentration, and fogging is to offer the image formation method which used this for the 1 component developer which can acquire a few high-definition picture, and its manufacture method row. Moreover, it is in offering the nonmagnetic 1 component developer and the image formation method of reaching the suitable amount of electrifications that the standup of electrification of other purposes of this invention is quick, and quick. Moreover, another purpose of this invention is to offer a nonmagnetic 1 component developer with little developer scattering in a developing machine also in long-term use. Moreover, the purpose of this invention is by using the resin electrification control agent of colorlessness or light color to offer the good color toner for nonmagnetic 1 component development

of color-reproduction nature. Furthermore, in a fixing process, other purposes of this invention have good toner detachability, and are to offer the nonmagnetic 1 component developer and the image formation method of having the fixing intensity which a quality-of-image deficit does not produce with external stress.

[0008]

[Means for Solving the Problem] As a result of inquiring wholeheartedly paying attention to the constituent and percentage of a resin electrification control agent, when the resin electrification control agent which has a following constituent and following percentage is used, this invention person etc. comes to acquire the knowledge that the high amount of electrifications and a sharp electrification distribution are obtained, and came to complete this invention. Namely, this invention is set to the 1 component developer which contains a binding resin, a coloring agent, and an electrification control agent at least. This electrification control agent at least as a monomer A sulfonate machine content monomer, It is the resin electrification control agent which makes a composition unit a perfluoro alkyl group content monomer and the aromatic monomer which has an electron withdrawing group. The repeat unit of this sulfonate machine content monomer receives a resin electrification control agent weight. 0.1 - 20 % of the weight, The repeat unit of this perfluoro alkyl group content monomer is the 1 component developer characterized by including the repeat unit of the aromatic monomer which has this electron withdrawing group one to 98% of the weight at 1 - 98% of the weight of a rate to a resin electrification control agent weight to a resin electrification control agent weight.

[0009]

[Embodiments of the Invention] Hereafter, this invention is explained in detail. The electrification control agent used by this invention is a resin electrification control agent which makes a composition unit a sulfonate machine content monomer, a perfluoro alkyl group content monomer, and the aromatic monomer that has an electron withdrawing group at least.

[0010] As a sulfonate machine content monomer which constitutes the resin electrification control agent of this invention, an aromatic sulfonate machine content monomer, an aliphatic sulfonate machine content monomer, etc. are mentioned. As an aromatic sulfonate machine content monomer, alkali-metal salts, such as a styrene sulfonic acid, a sulfo phenyl acrylamide, sulfo phenyl maleimide, and sulfo phenyl itaconimide, an alkaline-earth-metal salt, an amine salt, quarternary ammonium salt, etc. are mentioned. As an aliphatic sulfonate machine content monomer, alkali-metal salts, such as a vinyl sulfonic acid, an allyl-compound sulfonic acid, a 2-acrylamide-isobutane sulfonic acid, and a methacryloiloxy-ethyl sulfonic acid, an alkaline-earth-metal salt, an amine salt, quarternary ammonium salt, etc. are mentioned. Moreover, even if the composition unit of an organic-acid monomer itself contains the part as a composition unit in addition to the composition unit of a sulfonate machine content monomer, it does not interfere. An aromatic sulfonate machine is [ among these ] desirable. The salt of heavy metal, such as chromium, nickel, and mercury, is not desirable from the field of safety.

[0011] As a perfluoro alkyl group content monomer, perfluoro alkyl ethylene, perfluoro alkyl ethyl acrylate, perfluoro alkyl ethyl methacrylate, monochrome (perfluoro alkyl ethyl) maleate, monochrome (perfluoro alkyl ethyl) itaconate, etc. are mentioned, and the thing of 8-16 has especially the desirable carbon number of a perfluoro alkyl group.

[0012] As an aromatic monomer which has an electron withdrawing group Chloro styrene, dichloro styrene, a bromostyrene, fluoro styrene, Styrene substitution products, such as nitro styrene and cyano styrene, chlorophenyl (meta) acrylate, BUROMO phenyl (meta) acrylate, nitrophenyl (meta) acrylate, Phenyl (meta) acrylate substitution products, such as chlorophenyl oxy-ethyl (meta) acrylate and nitrophenyl oxy-ethyl (meta) acrylate, A chlorophenyl (meta) acrylamide, a BUROMO phenyl (meta) acrylamide, Phenyl (meta) acrylamide substitution products, such as a nitrophenyl (meta) acrylamide, Chlorophenyl maleimide, dichlorophenyl maleimide, nitrophenyl maleimide, Phenyl maleimide substitution products, such as nitro chlorophenyl maleimide, chlorophenyl itaconimide, Phenyl vinyl ether substitution products, such as phenyl itaconimide substitution products, such as dichlorophenyl ITANINIMIDO, nitrophenyl itaconimide, and nitro chlorophenyl itaconimide, chlorophenyl vinyl ether, and nitrophenyl vinyl ether, are mentioned. The phenyl maleimide substitution product and phenyl

itaconimide substitution product which were especially replaced by the chlorine atom or the nitro group are desirable.

[0013] As a monomer which constitutes the resin electrification control agent of this invention, the electrification grant effect of a resin electrification control agent improves by adding a sulfonate machine content monomer. Although such an electrification grant effect of a sulphur-containing compound is generally known, the problem that a resin electrification control agent serves as hygroscopicity, and the environmental stability (temperature and humidity stability) of a toner falls by the sulphur-containing compound on the other hand also has it. Then, in this invention, the copolymer which contains three sorts of monomers of not only a sulfonate machine content monomer but a sulfonate machine content monomer, a perfluoro alkyl group content monomer, and the aromatic monomer that has an electron withdrawing group to compensate this fault is used. Though the surface energy of a resin electrification control agent falls and a resin electrification control agent drops out of a toner front face while the electrification grant effect of a resin electrification control agent improves by making a perfluoro alkyl group content monomer into a constituent, contamination of a developing machine decreases, and the environmental stability (humidity stability) of a toner also improves. Moreover, by making into a constituent the aromatic monomer which has an electron withdrawing group, electrification of a toner can be raised more and a very narrow electrification distribution can be obtained. Therefore, the amount of conveyances to a developer support is stabilized, and the effect of excelling in the development nature of a toner is acquired. That is, in this invention, by using the copolymer containing three sorts of monomers, a sulfonate machine content monomer, a perfluoro alkyl group content monomer, and the aromatic monomer that has an electron withdrawing group, as a resin electrification control agent, for the first time, it excels in electrification nature and environmental stability, a 1 component developer with a sharp electrification distribution is obtained, and these effects can be maintained over a long period of time.

[0014] As a combination of these three sorts of monomers, a sulfonate machine content monomer is the alkali-metal salt of a styrene sulfonic acid, an alkaline-earth-metal salt, an amine salt, or quaternary ammonium salt, perfluoro alkyl group content monomers are perfluoro alkyl ethyl acrylate and perfluoro alkyl ethyl methacrylate, and the combination of the monomer whose aromatic monomers which have an electron withdrawing group are phenyl maleimide substitution products, such as chlorophenyl maleimide, dichlorophenyl maleimide, nitrophenyl maleimide, and nitro chlorophenyl maleimide, is desirable.

[0015] However, the sulfonate machine content monomer in this invention, a perfluoro alkyl group content monomer, and the aromatic monomer that has an electron withdrawing group are not limited to the compound of these above-mentioned.

[0016] The sulfonate machine content monomer of the percentage of the monomer in the resin electrification control agent of this invention is 1 - 10 % of the weight still more preferably 0.1 to 20% of the weight. Since the standup of electrification becomes bad and electrification of a toner becomes uneven when a sulfonate machine content monomer is less than 0.1 % of the weight, it is easy to affect a picture. Moreover, since the hydrophilic property of a resin electrification control agent will become high if it exceeds 20 % of the weight, environmental stability, especially the stability over humidity get worse. A perfluoro alkyl group content monomer is 1 - 70 % of the weight still more preferably one to 98% of the weight. When fewer than 1 % of the weight, it becomes easy to weld a developer or the resin electrification control agent which separated to a developing-machine part. The aromatic monomer which has an electron withdrawing group is 1 - 70 % of the weight still more preferably one to 98% of the weight. When fewer than 1 % of the weight, it is hard coming to obtain sufficient amount of electrifications, and becomes easy to generate a fogging and contamination inside the plane.

[0017] As for the softening temperature of the resin electrification control agent of this invention, it is desirable that it is 100-145 degrees C. Since the compatibility to a binding resin becomes good too much, distribution of a resin electrification control agent may become fine, and electrification nature may fall [ the case of less than 100 ]. Moreover, when exceeding 145 degrees C, the dispersibility in the inside of a toner not only falls, but it has a bad influence on the fixing nature of a toner, especially low-

temperature fixing nature. Softening temperature was measured with the elevated formula flow-tester tradename "CFT-500T" (Shimadzu Corp. make). First, about 1.05g sample was fabricated using the pressing machine, and carrying out the temperature up of the temperature, the amount of plunger descent was measured so that the load of 10kgf(s) might be applied by the plunger and a with a diameter length [ 1mm length of 1mm ] nozzle might be extruded. Softening temperature here is temperature from which melt viscosity becomes 104 Pa-s.

[0018] Moreover, as for the weight average molecular weight of the resin electrification control agent of this invention, 1000-500000 are good, and it is 2000-150000 preferably. The molecular weight still more preferably near the binding resin to be used is good. When weight average molecular weight is less than 1000, the compatibility to the inside of a binding resin will be too high, and electrification capacity will decline. Moreover, if 500000 is exceeded, while distribution into a binding resin will get worse, exposure increases in a toner front face and it has a bad influence on a fluidity and fixing nature.

[0019] Moreover, it can be made to be able to join together a binding resin, a polymer with analogous structure, the shape of a graft, and in the shape of a block, and the resin electrification control agent of this invention can be used, in order to raise distribution into a toner. That is, when using styrene system polymer as a binding resin, it is desirable to make it join together to a polyester system polymer, and to use to it, when using polyester system polymer to a styrene system polymer. In the case of a styrene system polymer, the homopolymer of styrene is sufficient, and the copolymer of styrene and other monomers which can be copolymerized is sufficient as it. As other monomers which can be copolymerized, aromatic vinyl hydrocarbons other than styrene, an acrylic (meta) monomer, a nitril system monomer, other vinyl system hydrocarbons, etc. are mentioned. In the case of a polyester system polymer, the polycondensation object of a polyol and a polycarboxylic acid etc. is mentioned.

[0020] The addition of the resin electrification control agent of this invention has 0.1 - 20 desirable % of the weight to a toner particle, and its 0.3 - 10 % of the weight is more desirable. When a resin electrification control agent is less than 0.1 % of the weight, the amount of electrifications becomes low, and when exceeding 20 % of the weight, in order for dispersibility to become bad and to form a big domain in a toner, an electrification distribution will become large and will affect fogging etc.

Moreover, 0.01-8 micrometers of diameters of distribution are 0.01-5 micrometers preferably. When the diameter of distribution is less than 0.01 micrometers, in a binding resin, full compatibility will be carried out and a lot of resin electrification control agents will be needed. Moreover, if it exceeds 8 micrometers, the problem that an electrification distribution becomes large will arise. Furthermore, when it uses for a color toner, the vividness of a color and transparency are affected. A toner cross section is observable as a means to check distribution with a transmission electron microscope etc.

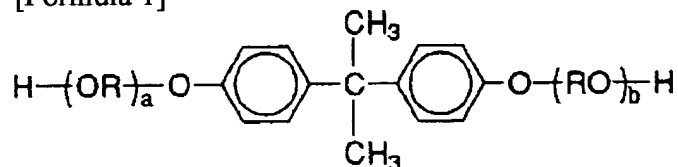
[0021] As a binding resin used by this invention, although well-known material, such as a polystyrene and styrene-acrylic-acid alkyl copolymer, a styrene-alkyl methacrylate copolymer, a styrene acrylonitrile copolymer, a styrene-butadiene copolymer, a styrene maleic anhydride copolymer, polyethylene, polypropylene, polyester, polyurethane, an epoxy resin, silicone resin, a polyamide, denaturation rosin, and paraffin wax, can be used, a styrene-acrylic copolymer and polyester are used preferably especially. Moreover, problem \*\*\*\*, like a \*\*\*\* defect arises at the time of bending which a toner image becomes thick by the color picture formation method in order that several sorts of toner layers may pile up, and originates in shortage of toner intensity, and a crack produces in a picture and by which glossiness is lost. In order to make moderate glossiness and outstanding on-the-strength \*\*\*\* hold from this, polyester resin with large molecule cohesive force is used especially preferably.

[0022] Although polyester resin can generally be obtained by the esterification reaction of polyhydric alcohol and a multiple-valued carboxylic acid, in this invention, the polyester resin obtained from following polyhydric alcohol and a following multiple-valued carboxylic acid is used suitably. As polyhydric alcohol, ethylene glycol, a propylene glycol, 1, 4-butanediol, 2, 3-butanediol, a diethylene glycol, a triethylene glycol, 1,5-pentanediol, 1, 6-hexandiol, neopentyl glycol, 1, 4-cyclohexane dimethanol, a dipropylene glycol, a polyethylene glycol, a polypropylene glycol, bisphenol A, hydrogenation bisphenol A, etc. can be used. The combined use with the bisphenol A derivative expressed especially with the following formula is desirable, and polyoxypropylene (6)-2 and 2-screw

(4-hydroxyphenyl) propane, a polyoxyethylene (2 2) -2, 2-screw (4-hydroxyphenyl) propane, the polyoxypropylene (2 0)-polyoxyethylene (2 0) -2, 2-screw (4-hydroxyphenyl) propane, etc. are mentioned as the example. Moreover, as an alcoholic component more than trivalence, a glycerol, a sorbitol, 1, 4-sorbitan, a trimethylol propane, etc. can be used.

[0023]

[Formula 1]



[0024] (R shows an ethylene or a propylene machine among a formula, and, as for both sum, 2-7 are [ both a and b ] integrally desirable.)

[0025] As a multiple-valued carboxylic acid, for example A maleic acid, a maleic anhydride, a fumaric acid, A phthalic acid, an isophthalic acid, a terephthalic acid, a malonic acid, a succinic acid, a glutaric acid, A dodeceny succinic acid, n-octyl succinic acid, 1 and 2, 4-naphthalene tricarboxylic acid, 1, 2, 4-cyclohexane tricarboxylic acid, 1 and 2, 5-hexane tricarboxylic acid, 1, 3-carboxyl-2-methyl-methylene carboxyl propane, tetrapod (methylene carboxy) methane, 1, 2 and 7, 8-octyl tetrapod carboxylic acid, trimellitic acid, pyromellitic acid, etc. can be used. Moreover, polyester resin can also be obtained according to the ester exchange reaction of the low-grade alkyl ester of these acids, and the aforementioned polyhydric alcohol.

[0026] As for the binding resin used by this invention, it is desirable for the ranges of the acid number to be 5-30. Since own electrification ability of resin is weak when the acid number is less than five, even if it uses the resin electrification control agent of this invention, electrification nature falls by the use over a long period of time, and there is a possibility of causing fogging and the quality-of-image defect to the non-picture section at the time of a toner shifting to a photo conductor. Moreover, since a structure top hydrophilic group increases when the acid number exceeds 30, it becomes easy to be influenced by temperature and humidity. Therefore, when the acid numbers are 5-30, the effect of the resin electrification control agent of this invention will become remarkable. Moreover, the softening temperature of a binding resin has the desirable range of 90-120 degrees C. When softening temperature is less than 90 degrees C, a non-offsetting temperature field cannot fully be secured, but when exceeding 120 degrees C, it is inferior to low-temperature fixing nature.

[0027] As a coloring agent of a toner used for this invention, a well-known thing can be used conventionally. As a coloring agent of such a toner, for example, carbon black, aniline blue, Cull coil blue, chrome yellow, ultra marine blue, E. I. du Pont de Nemours oil red, Quinoline yellow, methylene-blue chloride, a copper phthalocyanine, a Malachite-Green OKISA rate, Lamp black, a rose bengal, C. I. Pigment Red 48:1 and C.I. Pigment Red 122 and C.I. Pigment Red 57:1 and C.I. Pigment Yellow 97 and C.I. Pigment Yellow 12, C.I. Pigment Yellow 17, C.I. Pigment Yellow 180, C.I. Pigment Blue 15:1, C.I. Pigment Blue 15:3, etc. It can mention.

[0028] If it replaces with a coloring agent and the magnetic substance is used, it can use as a magnetic component developer. As the magnetic substance, ferrites, such as metallic oxides, such as metals, such as well-known magnetic-substance powder, for example, iron, cobalt, and nickel, and these alloys, Fe<sub>3</sub>O<sub>4</sub>, gamma-Fe<sub>2</sub>O<sub>3</sub>, and a cobalt addition iron oxide, a MnZn ferrite, and a NiZn ferrite, a magnetite, a hematite, etc. can be used. Organic compounds, such as non-subtlety particles, such as coupling agents, such as a silane coupling agent and a titanate coupling agent, and a silica, an alumina, a fatty-acid compound, and a resin, may be processed on the front face, and, generally, as for these magnetic substance, the range of 0.05-0.5 micrometers is suitable for particle size. As for the configuration of these magnetic substance, an octahedron, a hexahedron, and a globular form thing are used. As for these magnetic-substance powder, it is desirable to make it contain in 30 - 70% of the weight of the range in a toner particle. When magnetic-substance powder is less than 30 % of the weight, the restraint of the

toner by the magnetism of a developer support declines, and the problem of scattering of a toner arises. On the other hand, when surpassing 70 % of the weight, the problem that the repeatability of picture concentration falls occurs.

[0029] If the 1 component developer of this invention contains a binding resin, an above-mentioned coloring agent, and an above-mentioned electrification control agent at least, there is especially no limit and it can also use other additives if needed.

[0030] For example, you may add a release agent in order to raise a gross and offset nature. As a release agent, eight or more-carbon number paraffin, a polyolefine, etc. are desirable, for example, they are paraffin wax, a paraffin latex, and a micro crystalline wax. polypropylene or polyethylene is mentioned and carnauba wax etc. is independent in these -- or it can use together and use

[0031] Moreover, a plasticizer particle may be added and electric conduction powder may be added for the purpose on a charge-exchange disposition in order to give a moderate fluidity and electrification nature to a developer. Moreover, you may add and use additives, such as lubricant and an abrasive material, in order to prevent the toner to a cleaning disposition top or a photo conductor, an external additive, the sunspot by adhesion of talc, a flake, a white omission, a comet, filming, etc. resin impalpable powders, such as organic impalpable powders, such as non-subtlety powder, such as hydrophobic silica and hydrophobing processing particle titanium oxide and an alumina, a fatty acid or its derivative, and a metal salt, a fluorine system resin, an acrylic resin, or a styrene resin, a cerium oxide, a magnetite, etc. are mentioned, and independent [ in these ] as the plasticizer particle and additive which are used, -- or it can use together and use For example, a V type blender, a Henschel mixer, or a REDIGE mixer can perform these mixtures.

[0032] The particle size of the toner used for this invention has desirable 4-12 micrometers at a volume mean particle diameter, and its 6-10 micrometers are more desirable. Since a fluidity will get worse remarkably if a volume mean particle diameter is smaller than 4 micrometers, layer formation cannot be performed well but tends to cause fogging and dirt. Moreover, since high definition is not only no longer obtained, but resolution will fall and the amount of electrifications per unit weight of a developer will fall if it exceeds 12 micrometers, layer formation maintenance nature is bad and it becomes easy to generate fogging and dirt.

[0033] The 1 component developer of this invention can be manufactured by any well-known methods. For example, after carrying out preliminary mixture of a kneading pulverization method, i.e., a binding resin and a coloring agent, and the resin electrification control agent, melting kneading is carried out with a kneading machine, pulverization and a classification can be performed after cooling, addition mixture of the external additive particle can be carried out, and it can manufacture with the method of manufacturing a toner, and the polymerization method by the suspension polymerization, the emulsion polymerization, etc. Moreover, in a kneading pulverization method, in kneading simultaneously a binding resin, a coloring agent, and a resin electrification control agent, it is needed from a viewpoint of the compatibility of a resin electrification control agent and a binding resin that the difference of the softening temperature (Tmc) of a resin electrification control agent and the softening temperature (Tmr) of a binding resin is 40 degrees C or less. When the difference exceeds 40 degrees C, the compatibility of a resin electrification control agent and a binding resin will become bad, the distributed state of the resin electrification control agent in a toner will get worse, and poor electrification will arise. Therefore, when manufacturing by the kneading pulverization method, it is desirable to knead beforehand some binding resins and a resin electrification control agent, and to add and knead the remainder and the coloring agent of a binding resin further. It is not to receive the restrictions by the softening temperature of a binding resin, and for the width of face of selection of a resin electrification control agent to spread by kneading a binding resin and a resin electrification control agent beforehand, since a certain amount of compatibility is securable.

[0034] The nonmagnetic 1 component developer of this invention contains the above-mentioned binding resin, a coloring agent, and a resin electrification control agent at least. The latent-image formation process which forms an electrostatic latent image on an electrostatic latent-image supporter, the development process which develops the latent image on this latent-image supporter using the developer

by which thin layer formation was carried out on a developer support, It is used as a developer of the image formation method of having the imprint process which imprints the toner picture on a latent-image supporter on an imprint object, and the fixing process established in the toner picture on an imprint object. It is especially used for yellow, a Magenta, cyanogen, and the full color image formation method using four colors of black preferably. A well-known method is conventionally applicable to a latent-image formation process (process which forms a latent image in a latent-image supporter). In a latent-image formation process, an electrostatic latent image is formed on latent-image supporters, such as a photosensitive layer or a dielectric layer, by the xerography or the electrostatic recording method. As a photosensitive layer of the latent-image supporter used for this invention, well-known things, such as an organic system and an amorphous silicon, can be used. Moreover, a latent-image supporter extrudes aluminum or an aluminium alloy, and is obtained by the well-known process, such as carrying out surface treatment, after molding, and the thing of desirable configurations, such as the shape of the shape of a cylinder and a belt, can be used for it according to equipment.

[0035] In a development process (process which develops the latent image on a latent-image supporter) On the turning-circle barrel as a developer support (development roll), thin layer formation of the toner is carried out in layer specification-part material. It conveys to a development nip, in the development section, contact or a fixed gap is prepared, a development roll and the latent-image supporter holding an electrostatic latent image are arranged, and an electrostatic latent image is developed with a toner, impressing bias between a development roll and a latent-image supporter. In this invention, it is the point of the stress to a developer, especially the embedding of an external additive, and it is desirable to arrange a developer support to non-contact a latent-image supporter top. The turning-circle barrel by which the magnet was built in the interior as a developer support is used, in the case of magnetic 1 component development, the toner which has the magnetic substance is conveyed in a magnetic force, and it is held. In the case of nonmagnetic 1 component development, the pressure welding of the toner supply rolls, such as urethane sponge, etc. is carried out to a developer support, and the method of supplying a toner on a developer support is taken.

[0036] The elastic body sleeve which made silicone rubber, NBR, EPDM, etc. distribute electric conduction agents, such as carbon, as a developer support used for this invention, In order to control the sleeve which drew out and carried out metals and ceramics, such as aluminum and SUS, and the conveyance nature and electrification nature of a toner Oxidization or metal plating on the front face of a base, The thing which coated the polymer coat layer which distributed an electrification control agent, an electric conduction agent, lubricant, etc. to resins, such as an acrylic and a phenol, or this, the plastics sleeve which really cast these are used for what performed surface treatment, such as polish and blast processing, or these bases.

[0037] Toner layer regulation can make an elastic blade metallurgy group blade etc. able to contact a developer support body surface, and can perform it. In the case of an elastic blade, rubber elasticity objects, such as silicone rubber and polyurethane rubber, are used preferably, and when it is a metal blade, SUS, aluminum, a phosphor bronze, etc. are used preferably. in order [ moreover, ] to control electrification of a developer -- the organic substance or an inorganic substance -- a coat -- you may do addition and distribution (elastic blade) of

[0038] As a method of developing 4 color toner especially, arrange the developing machine of 4 color toner around a latent-image supporter, and each color toner is received. A latent-image formation process and a development process to one photo conductor A four-cycle \*\*\*\*\* method, The method which installs the method and four photo conductors which develop 4 color toner in 1 cycle of a latent-image formation process and a development process to one photo conductor, and the developing machine of 4 color toner, is attached to one photo conductor, and develops the toner of one color is held.

[0039] Once imprinting a toner image on the middle imprint object of the shape of the non-contact type imprint method imprinted using the contacted type imprint method and the corotron which is made to carry out the pressure welding of an imprint roller, the imprint belt, etc. to a latent-image supporter, and imprints a toner image on an imprint object or the shape of a belt, and a cylinder, well-known methods,

such as the method which imprints on an imprint object, are used for an imprint process (the process which imprints the toner picture on a The method which imprints at a time one color of toner images formed on the photo conductor to imprint drum lifting which twisted the transferred object, and lays them on top of it as a method which piles up 4 color toner, After imprinting the toner image formed on the photo conductor on an imprint object and piling up a color toner image on an imprint object, the method which carries out a package imprint, the method which carries out the package imprint of the color toner on a photo conductor are held on a transferred object.

[0040] In a fixing process (process established in the toner picture on an imprint object), the toner picture imprinted by the imprint object is established in a fixing assembly. The heat fixing method using a heat roll as a fixing means is desirable.

[0041] Moreover, in the image formation method of this invention in this invention, a cleaning process can also be established suitably. A cleaning process is a process which removes with a cleaner the toner which remained in the latent-image supporter, without imprinting at an imprint process, and well-known things, such as blade cleaning or roller cleaning, are raised as a cleaning means. The blade which consists of India rubbers, such as silicone rubber and polyurethane rubber, is used for blade cleaning. However, a cleaning process is not indispensable and the image formation method of this invention can also be applied to the so-called cleaner loess system which does not establish a cleaning process.

[0042]

[Example] Hereafter, although an example explains this invention still more concretely, this invention is not limited to these examples. In addition, as long as there is no notice especially in the following explanation, all the "sections" means the "weight section."

[0043] (Composition of the resin electrification control agent A) G tert-butyl peroxide was copolymerized for the styrene sulfonic-acid sodium 6 section, the perfluoro alkyl ethyl methacrylate 50 section, and the nitrophenyl maleimide 44 section as an initiator under the boiling point in DMF, subsequently, the reduced-pressure-drying machine removed DMF and the softening temperature  $T_{mc}=137$  degree C resin electrification control agent A was obtained.

[0044] (Composition of the resin electrification control agent B) The styrene sulfonic-acid sodium 8 section, perfluoro alkyl ethyl acrylate 60 section and 3, and 4-dichlorophenyl maleimide 32 section was copolymerized like the resin electrification control agent A, and the softening temperature  $T_{mc}=120$  degree C resin electrification control agent B was obtained.

[0045] (Composition of the resin electrification control agent C) The styrene sulfonic-acid sodium 5 section, perfluoro alkyl ethyl acrylate 50 section and 3, and 4-dichlorophenyl maleimide 45 section was copolymerized like the resin electrification control agent A, and the softening temperature  $T_{mc}=115$  degree C resin electrification control agent C was obtained.

[0046] (Composition of the resin electrification control agent D) The styrene sulfonic-acid sodium 5 section, perfluoro alkyl ethyl methacrylate 60 section and 3, and 4-dichlorophenyl maleimide 35 section was copolymerized like the resin electrification control agent A, and the softening temperature  $T_{mc}=132$  degree C resin electrification control agent D was obtained.

[0047] (Composition of the resin electrification control agent E) The styrene sulfonic-acid sodium 10 section and the styrene 90 section were copolymerized like the resin electrification control agent A, and the softening temperature  $T_{mc}=135$  degree C resin electrification control agent E was obtained.

[0048] (Composition of the resin electrification control agent F) The styrene sulfonic-acid sodium 40 section and the perfluoro alkyl ECHIRUARI rate 60 section were copolymerized like the resin electrification control agent A, and the softening temperature  $T_{mc}=125$  degree C resin electrification control agent F was obtained.

[0049] (Composition of the resin electrification control agent G) The styrene sulfonic-acid sodium 40 section, the perfluoro alkyl ethyl methacrylate 30 section, and the nitrophenyl maleimide 30 section were copolymerized like the resin electrification control agent A, and the softening temperature  $T_{mc}=127$  degree C resin electrification control agent G was obtained.

[0050] (Manufacture of a binding resin) The polyhydric alcohol and the multiple-valued carboxylic acid of the raw material composition shown in Table 1 are put in into the 4 mouth round bottom flask of a 1l.

capacity equipped with the agitator, the glass nitrogen gas introduction pipe, and flowing-down formula capacitor made from a stainless steel, and this flask is set to a mantle heater. Subsequently, the temperature up was carried out, having introduced nitrogen gas and maintaining the inside of a flask at an inert atmosphere from a nitrogen gas introduction pipe. Then, the 0.05g dibutyl tin oxide was added, reaction temperature was kept at 210 degrees C, and the following binding resin was obtained by carrying out a predetermined-time reaction.

[0051]

[Table 1]

		結着樹脂 (ポリエステル樹脂)			
		(1)	(2)	(3)	(4)
アル コ ー ル 成 分	ビスフェノールA エチレンオキシド付加物	30	25	35	30
	ビスフェノールA 加ビニ オキシド付加物	20	25	10	20
	シクロヘキサジオール			5	
酸 成 分	テレフタル酸	40	40	35	30
	無水トリメリット酸	10	10	15	20
酸 価		10	12	20	40
軟 化 点		105	110	115	105

[0052] (Nonmagnetic 1 component image formation equipment) Drawing 1 is the rough block diagram of the nonmagnetic 1 component image formation equipment used in the example. The developing machine which has a nonmagnetic toner consists of a developer support 3 made from aluminum which carried out sandblasting of the front face and was set to average surface roughness Ra 0.5micrometer, and a developer supply brush 4 which made the acrylic resin distribute carbon black. The developer support 3 has been arranged by non-contact with the latent-image supporter 1 and a 150-micrometer gap. Moreover, after electrifying the latent-image supporter 1 with the roller electrification vessel 2, it developed the electrostatic latent image, exposing it by the laser beam, it forming an electrostatic latent image, and applying Vpp2.0kV, alternating voltage with a frequency of 2.0kHz, and the direct current voltage of -300V to the developer support 3, the developer supply roller 4, and the developer layer specification-part material 5. The toner stratification in a developer support made the developer layer specification-part material 5 contact the developer support 3 with a fixed linear pressure, and performed it to it. Moreover, the peripheral speed of the latent-image supporter 1 made 120 mm/s peripheral speed of 80 mm/s and the developer support 3, and, in the imprint of a toner, cleaning used the blade formula cleaner using the imprint roller. Fixing used the heat roller fixing assembly.

[0053]

An example 1 A binding resin (1) 93 weight sections A copper copper-phthalocyanine-blue pigment 5 weight sections The resin electrification control agent A The 2 weight sections above-mentioned material was kneaded with the biaxial knockout kneading machine in the setting temperature of 140 degrees C, screw-speed 800rpm, and speed-of-supply 150 kg/h, after carrying out preliminary mixture in a Henschel mixer. After cooling, after carrying out coarse grinding, it pulverized with the jet mill, this trituration object was further classified with the pneumatic elutriation machine, and the toner particle whose volume mean particle diameter D50 is 7.6 micrometers was obtained. In the obtained classification article toner particle 100 weight section, the rutile-type-titanium-dioxide 1.0 weight section which carried out hydrophobing processing as an external additive by decyltrimetoxysilane of the dimethyl silicone-oil processing silica 0.8 weight section of 12nm of mean particle diameters and 15nm of mean particle diameters was mixed in the Henschel mixer, and the 1 component developer 1 was produced in it. Using the nonmagnetic 1 component image formation equipment which shows the 1 component developer 1 to drawing 1, under a high-humidity/temperature environment and low-

humidity/temperature environment (28 degrees C, 85%RH) (10 degrees C, 15%RH), the print test of 10,000 sheets was performed, respectively and evaluation of an electrification performance and quality of image was performed by the following method. The high definition which does not have sufficient picture concentration and a background fogging in the bottom of which environment continued, and was obtained. An evaluation result is shown in Table 2 and Table 3.

[0054] (The electrification nature evaluation method)

The toner was made to convey on the <amount of initial electrifications> sleeve, and it measured by the suction TORIBO measuring method under each environment after 24-hour neglect under each environment. The amount of electrifications of 10,000 sheets after was measured similarly.

According to the following formula, the <environmental difference> environmental difference performed comprehensive evaluation, and judged it on the following criteria.

Environmental difference = (amount [ +10,000 sheets after amount of initial electrifications x (the amount of amount of high-humidity/temperature electrifications / low-humidity/temperature electrifications) ] of electrifications x (the amount of amount of high-humidity/temperature electrifications / low-humidity/temperature electrifications)) / 20.8 < environmental difference ..... 00.5  
 <= environmental difference <=0.8 ..... \*\* environmental difference <0.5 ..... According to the following formula, x <maintenance nature> maintenance nature performed comprehensive evaluation, and judged it on the following criteria.

Maintenance nature = (amount of amount of high-humidity/temperature electrifications x (amount of initial electrifications of amount of electrifications / x of 10,000 sheets after) + low-humidity/temperature electrifications x (the amount of initial electrifications of amount of electrifications / x of 10,000 sheets after)) / 20.7 < maintenance nature ..... 0 0.5 <= maintenance nature <=0.7 ..... \*\* maintenance nature <0.5 ..... The electrification distribution of the toner on the sleeve 10,000 sheets after x <electrification distribution> was measured with the electrification distribution measuring instrument, the center of a distribution was broken by width of face of a distribution, and was searched for, and it judged on the following criteria.

0.6 < electrification distribution center ..... 00.4 <= electrification distribution center <=0.6 ..... \*\* electrification distribution center <0.4 ..... x [0055] (The quality-of-image evaluation method)

It measured with the density measurement vessel made from <picture concentration> X-rite "X-rite404A."

It fogged on < print, and with the >50 time magnifier, the background was observed and organic-functions evaluation was carried out. It is completely nothing and a little and the dovetail was considerably estimated as O, \*\*, and x, respectively.

Among 120-220 degrees C, it was established raising temperature gradually and the fixing temperature of <low-temperature fixing nature> 160 mm/sec estimated the low-temperature fixing nature of a toner picture. In addition, low-temperature fixing nature bent the 40mmx50mm solid toner picture using the weight of a fixed load, and attached grade according to the degree of the picture deficit of the portion. It considered as the index of low-temperature fixing nature by making into the minimum fixing temperature fixing temperature which serves as grade of G1 and G2 among the following grade.

G1; There is no deficit of a picture in a bending portion.

G2; Although line-like marks remain in a bending portion, lack of a picture is level which there is not and is satisfactory.

G3; A line white in some places goes into a bending portion, and a picture is missing.

G4; Picture lack arises besides a bending portion.

And the minimum fixing temperature made 140 degrees C or less tolerance, it was estimated as O, and the thing exceeding 140 degrees C was estimated as x.

Among 120-220 degrees C, it was established raising temperature gradually and the fixing temperature of <offset nature> 160 mm/sec estimated offset nature. Offset nature estimated the case where offset generating temperature was higher than 200 degrees C as O, estimated the case of 180 degrees C or more as \*\*, and estimated the low case as x from it.

At 160 degrees C, the sample was produced at the fixing speed of <transparency> 60 mm/sec.

Transparency was measured for this using "Match Scan II" (product made from DINO). PE value estimated 85 or more things as O, estimated the case of 75 or more as \*\*, and estimated less than 75 as x.

[0056]

[Table 2]

	初期帯電量 (μC/g)		1万枚後帯電量 (μC/g)		総合帯電評価		
	高温高湿	低温低湿	高温 高湿	低温 低湿	環境差	維持性	帯電 分布
実施例 1	-18	-20	-16	-22	○	○	○
実施例 2	-17	-21	-15	-19	○	○	○
実施例 3	-14	-16	-12	-15	○	○	○
実施例 4	-16	-19	-17	-20	○	○	○
比較例 1	-9	-30	-4	-28	×	△	×
比較例 2	-9	-36	-6	-18	×	×	×
比較例 3	-10	-28	-4	-12	×	×	×
比較例 4	-3	-22	-1	-15	×	×	×

[0057]

[Table 3]

	高温高湿環境 1万枚後		低温低湿環境 1万枚後		最低定着 濃度	ホット オフセット	透明性	総合 評価
	濃 度	かぶり	濃 度	かぶり				
実施例 1	1.60	○	1.51	○	○	○	○	○
実施例 2	1.58	○	1.49	○	○	○	○	○
実施例 3	1.52	○	1.43	○	○	○	○	○
実施例 4	1.56	○	1.44	○	○	○	○	○
比較例 1	1.42	×	1.16	×	×	×	×	×
比較例 2	1.32	△	1.22	×	×	×	×	×
比較例 3	1.34	×	1.20	×	○	○	×	×
比較例 4	1.42	×	1.13	×	○	○	○	×

[0058]

Example 2 Binding resin (1) 93 weight sections Copper copper-phthalocyanine-blue pigment 5 weight sections Resin electrification control agent B The toner particle whose volume mean particle diameter D50 is 8.2 micrometers like an example 1 about the 2 weight sections above-mentioned material was obtained. The same external additive as an example 1 was added, and the 1 component developer 2 was produced. When the same print test as an example 1 was performed, the high definition which does not have sufficient picture concentration and a background fogging in the bottom of which environment continued, and was obtained. An evaluation result is shown in Table 2 and Table 3.

[0059]

Example 3 Binding resin (2) 93 weight sections Copper copper-phthalocyanine-blue pigment 5 weight sections Resin electrification control agent C The toner particle whose volume mean particle diameter D50 is 7.2 micrometers like an example 1 about the 2 weight sections above-mentioned material was obtained. Furthermore, the rutile-type-titanium-dioxide 1.0 weight section which carried out hydrophobing processing as an external additive by decyltrimetoxysilane of the hexamethylene silazane processing silica 0.8 weight section of 16nm of mean particle diameters and 15nm of mean particle diameters was mixed in the Henschel mixer, and the 1 component developer 3 was produced. When the

same print test as an example 1 was performed, the high definition which does not have sufficient picture concentration and a background fogging in the bottom of which environment continued, and was obtained. An evaluation result is shown in Table 2 and Table 3.

[0060]

Example 4 Binding resin (3) 93 weight sections Copper copper-phthalocyanine-blue pigment 5 weight sections Resin electrification control agent D The toner particle whose volume mean particle diameter D50 is 7.4 micrometers like an example 1 about the 2 weight sections above-mentioned material was obtained. Furthermore, the same external additive as an example 3 was added, and the 1 component developer 4 was produced. When the same print test as an example 1 was performed, the high definition which does not have sufficient picture concentration and a background fogging in the bottom of which environment continued, and was obtained. An evaluation result is shown in Table 2 and Table 3.

[0061]

Example 1 of comparison Binding resin (1) 93 weight sections Copper copper-phthalocyanine-blue pigment 5 weight sections Resin electrification control agent E The toner particle whose volume mean particle diameter D50 is 7.6 micrometers like an example 1 about the 2 weight sections above-mentioned material was obtained. The same external additive as an example 1 was added, and the 1 component developer 5 was produced. When the same print test as an example 1 was performed, fogging was seen from the start of a test. An evaluation result is shown in Table 2 and Table 3.

[0062]

Example 2 of comparison Binding resin (4) 93 weight sections Copper copper-phthalocyanine-blue pigment 5 weight sections Resin electrification control agent E The toner particle whose volume mean particle diameter D50 is 7.6 micrometers like an example 1 about the 2 weight sections above-mentioned material was obtained. The same external additive as an example 1 was added, and the 1 component developer 6 was produced. When the same print test as an example 1 was performed, the environmental dependency was large, and under high-humidity/temperature, fogging was bad especially, and it was low quality-of-image concentration. An evaluation result is shown in Table 2 and Table 3.

[0063]

Example 3 of comparison Binding resin (4) 93 weight sections Copper copper-phthalocyanine-blue pigment 5 weight sections Resin electrification control agent F The toner particle whose volume mean particle diameter D50 is 7.8 micrometers like an example 1 about the 2 weight sections above-mentioned material was obtained. The same external additive as an example 3 was added, and the 1 component developer 7 was produced. When the same print test as an example 1 was performed, the environmental dependency was large, especially, under high-humidity/temperature, fogging is low quality-of-image concentration bad, and the result that fogging was bad was obtained under low-humidity/temperature. An evaluation result is shown in Table 2 and Table 3.

[0064]

Example 4 of comparison Binding resin (1) 93 weight sections Copper copper-phthalocyanine-blue pigment 5 weight sections Resin electrification control agent G The toner particle whose volume mean particle diameter D50 is 8.2 micrometers like an example 1 about the 2 weight sections above-mentioned material was obtained. The same external additive as an example 3 was added, and the 1 component developer 8 was produced. When the same print test as an example 1 was performed, the environmental dependency was large, electrification level was low under high-humidity/temperature especially, there is much toner \*\*\*\*\* and dirt inside the plane arose. Moreover, under low-humidity/temperature, since electrification level was high, the result that concentration nonuniformity and a fogging got worse was obtained. An evaluation result is shown in Table 2 and Table 3.

[0065] If the 1 component developer of this invention shows high electrification nature and a sharp electrification distribution from examples 1-4 and image formation is performed using this, it turns out that the high definition which does not have sufficient picture concentration and a sufficient background fogging, and a picture top line not only in the bottom of a high-humidity/temperature environment but in the bottom of the low-humidity/temperature environment where fixing of a toner tends to occur by high electrification can maintain to 10,000 sheets. That is, it turns out that an electrification performance is

maintainable over a long period of time, and high definition continues and is obtained. On the other hand, although a resin electrification control agent uses a sulfonate machine content monomer as a composition unit In consisting of a resin which does not make a composition unit a perfluoro alkyl group content monomer and the aromatic monomer which has an electron withdrawing group Since the amount of electrifications decreases and an electrification distribution also serves as broadcloth, it turns out that picture concentration and quality of image become inadequate, and it is inferior also to low-temperature fixing nature, offset nature, and transparency by both under a high-humidity/temperature environment and low-humidity/temperature environment (examples 1 and 2 of comparison). Moreover, although a resin electrification control agent uses a sulfonate machine content monomer and a perfluoro alkyl group content monomer as a composition unit Since the amount of electrifications decreases and an electrification distribution also serves as broadcloth when consisting of a resin with which a composition unit does not carry out the aromatic monomer which has an electron withdrawing group, they are both under a high-humidity/temperature environment and low-humidity/temperature environment. It turns out that picture concentration and quality of image become inadequate, and dispersibility gets worse since the difference of softening temperature is large, and it is inferior not only to electrification nature but transparency (example 3 of comparison). Furthermore, when the balance of the composition unit of the resin electrification control agent of this invention is important and these composition shifts greatly, it turns out that the dispersibility to the inside of a toner and electrification nature (starting a distribution, an environmental dependency) get worse (example 4 of comparison). [0066]

[Effect of the Invention] According to the 1 component developer of this invention, over a long period of time, electrification and conveyance of a toner are stabilized and the stable picture concentration without fogging or concentration nonuniformity is obtained. Moreover, even if a toner deteriorates by continuous duty, the electrification distribution of a toner is sharp, and since there are few falls of the amount of electrifications, it is possible to acquire the picture which does not have problems, such as change of picture concentration, low development nature, and fogging, and was excellent in fixing nature. Moreover, in heating roller fixing, it is good, and with external stress, the image formation method of this invention cannot produce a quality-of-image deficit easily, and the detachability of a toner excels [ method ] in low-temperature fixing nature and offset-proof nature.

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[Translation done.]